KPPC
Kentucky's Resource Center for Environmental Sustainability

KPPC - Kentucky Pollution Prevention Center

Save Energy Now: Using the ENERGY STAR® 7-Step Process for Energy Management

2013 Annual Pollution Prevention Conference and Trade Show

September 25, 2013

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Executive Director

Richard Meisenhelder
Technical Services Program Manager

Bruce Hepke
Sustainability Engineer

J.B. SPEED SCHOOL OF ENGINEERING

STAY FOCUSED ON THE TASK

Today's Presenters from KPPC

Cam Metcalf

Executive Director, KPPC

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Technical Services Program Manager, KPPC

Bruce Hepke

Sustainability Engineer, KPPC

Agenda

- Introductions
- 7 Steps of Energy Management
- Energy Policy & Team
- Baseline & Benchmarking
- Identifying Opportunities
- Action Plan Exercise

What is KPPC?

- KPPC is a non-profit organization established by the General Assembly in 1994 through a state legislative mandate
- Provides technical assistance & outreach programs to Kentucky businesses, industries & organizations
- Based at the UofL J.B. Speed School of Engineering
- Mission:

  KPPC is Kentucky's primary resource to help businesses, industries and other organizations develop environmentally sustainable, cost-saving solutions for improved efficiency.

What does KPPC do?

All services are confidential and non-regulatory

- Core Sustainability Services are free, and include training, site visits, and web-based tools to assist with:
  - Solid & hazardous waste and toxics use reduction
  - Water/wastewater conservation
  - Air emission reduction

Additional Services are **free or grant subsidized**:

- Energy efficiency (E2)
  - USDA REAP (small, rural, independently-owned businesses)
  - DOE KY SEN (energy-intensive industrial and commercial)
- Customized assistance in any of the above

Evolving Definitions & Programs

Waste Minimization (WM)

- The reduction, to the extent feasible, in the amount of *hazardous waste generated* prior to any treatment, storage, or disposal of the waste. Because waste minimization efforts eliminate waste before it is generated, *disposal costs may be reduced*, and ...

WM Program-in-Place

- 40 CFR 262.27(a): "I am a large quantity generator. *I have a program-in-place* to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable…

Innovative & effective approaches to WM, including:

- Lean Manufacturing
- Energy Recovery
- Environmental Management Systems (EMS)
- Green Chemistry

WM Program-in-Place

In 1989, EPA provided *guidance* on the six (6) WM program-in-place elements:

- Provide top management support
- Characterize waste generation & waste management costs
- Perform periodic waste minimization assessments
- Maintain a cost allocation system
- Encourage technology transfer
- Implement program & conduct evaluations

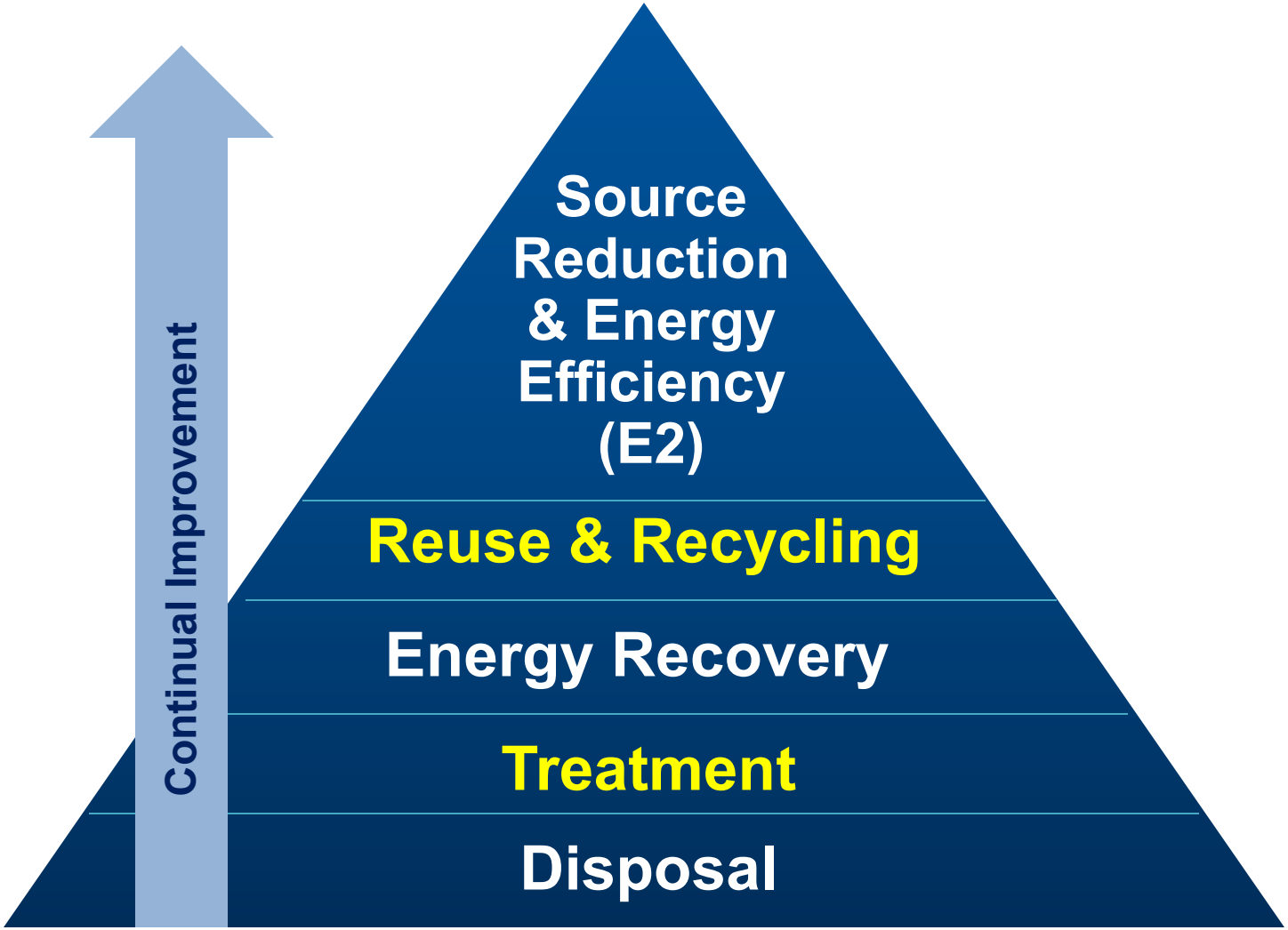
Pollution Prevention Definition

Pollution Prevention means “Source Reduction” and other practices that reduce or eliminate the creation of pollutants through:

- increased efficiency in the use of raw materials, energy, water or other resources, or
- protection of natural resources by conservation.

Resource Management

Proactive Planning: Move Up the Hierarchy



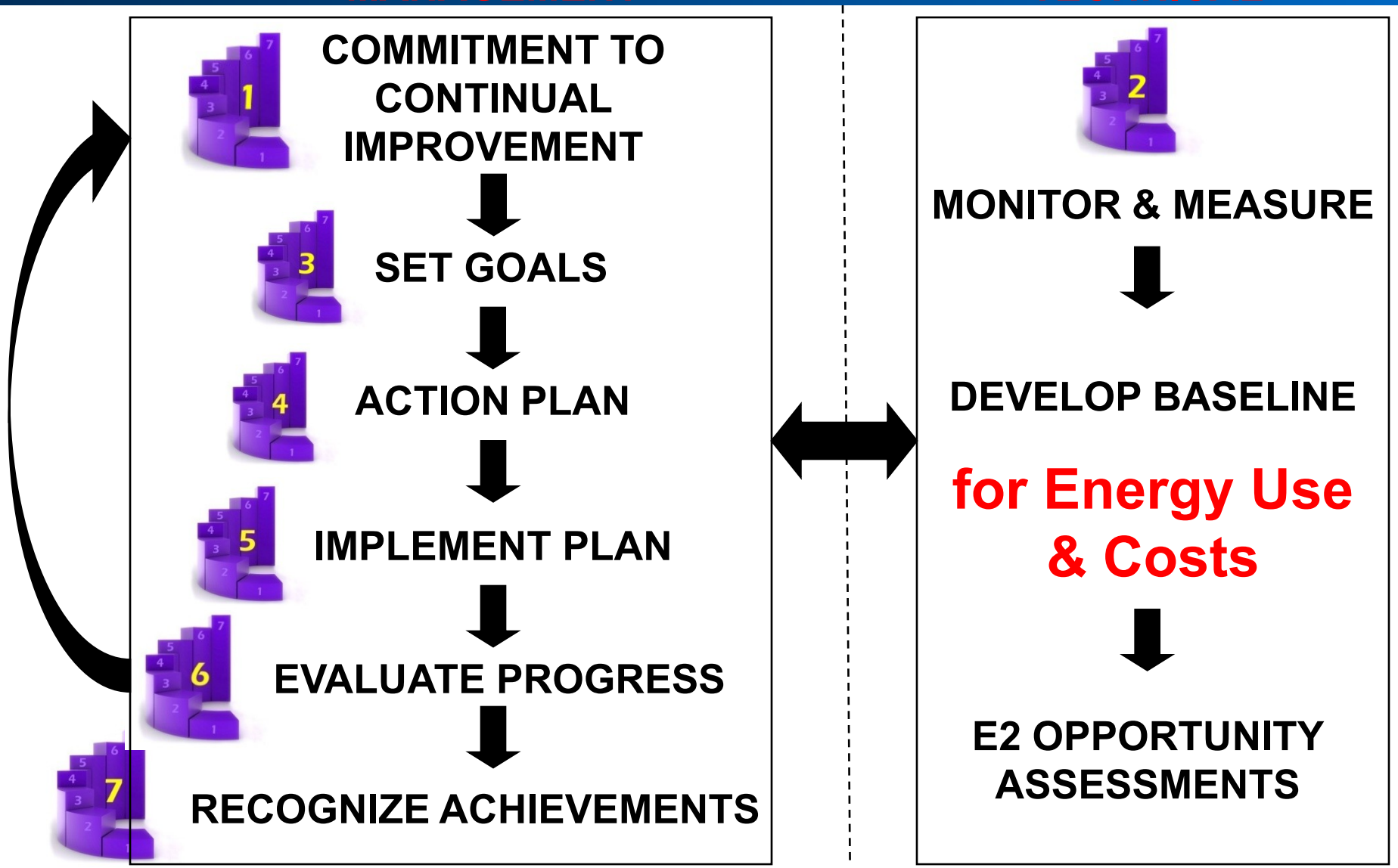
Why a Systems Approach? It's Value Added

- Strengthens management focus on environmental & energy performance, injects organizational discipline across functional silos
- Creates opportunity for cultural shift; encourages commitment across company, BEYOND compliance & the 'low hanging fruit'
- Introduces & sustains a systematic approach to efficiency & wise use of resources
- Requires management commitment of resources appropriate to the goals of P2/E2/EMS/EnMS and can be linked to QMS that ties back to profit margin
- Based on measurement and verification

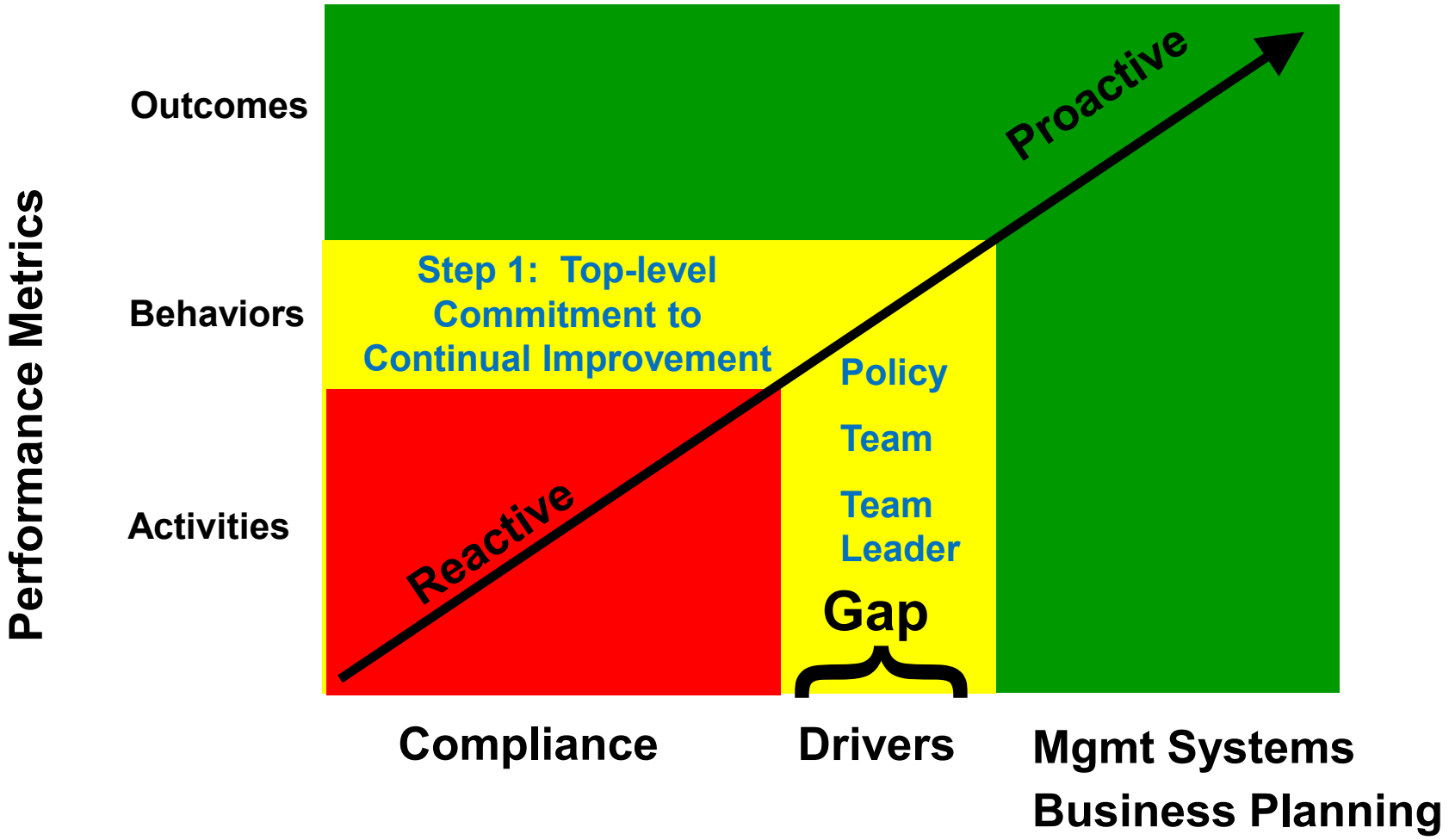
7-Step Process for E2 Management Program

MANAGEMENT

TECHNICAL



Organizational Capability



7-Step Energy Management Process (EMP)

Make Commitment to Continual Improvement

- ✓ Energy Policy
- ✓ Cross-functional Energy Team
- ✓ Appoint Energy Team Leader

Assess Performance & Opportunities

- ✓Track & monitor energy use & costs
- ✓Develop baseline (& benchmark)
- ✓Identify energy use reduction opportunities

Assess Performance & Opportunities

- Process of evaluating current & past energy use and costs for all major facilities & functions
- Analyze energy use to:
  - Identify energy opportunities
  - Improve energy performance
  - Gain financial & environmental benefits
- Key aspects of assessing performance include:
  - Data collection & management
  - Data analysis
  - Baselining & benchmarking
  - Technical E2 assessments

Don't Just Pay the Bill!

7-Step Energy Management Process (EMP)

Set Goals

✓Performance goals

✓Clear & measurable goals

✓Guide daily decision-making

What goals do you want to set for your:

- Team?
- Company?

7-Step Energy Management Process (EMP)

Create Action Plan

- ✓Roadmap to improve energy use performance
- ✓Ensures a systematic process
- ✓Regularly updated to reflect achievements

Kindred Energy Management Action Plan

Creating an energy management plan that will promote and track energy conservation

Based on the EPA's Energy Star recommendations for an Energy Management Plan

- Completed in 2010
- Completed in 2011
- Implemented in 2012
- Future and on-going

FetterGroup's Quarterly Objectives

7 Step Process

Make Commitment to Continual Improvement

Assess Performance & Opportunities

Set Goals & Objectives

Fetter will:

- ✓ Increase staff awareness
- ✓ Complete development of social & environmental management manual
- ✓ Pursue participation as a partner in the EPA's Energy Star, Climate Leaders & Waste Wise programs

- ✓ Identify, assess & manage social & environmental risks

- ✓ Document the achievement of objectives

FetterGroup's Quarterly Objectives

7 Step Process	Fetter will:
 Create Action Plan	✓ Update the 40" Lithographic Press Process Plan with sustainability components ✓ Create a "Green Label" Information Packet for our customers
 Implement Action Plan	✓ Implement energy management projects
 Evaluate Progress	✓ Issue first project scorecard
 Recognize Achievements	✓ Recognize internal contributors to the continual improvement projects for sustainability

7-Step Energy Management Process (EMP)

Implement Action Plan

- ✓Investigate & verify options
- ✓Develop & justify capital investment
- ✓Develop a timeline
- ✓Identify resources

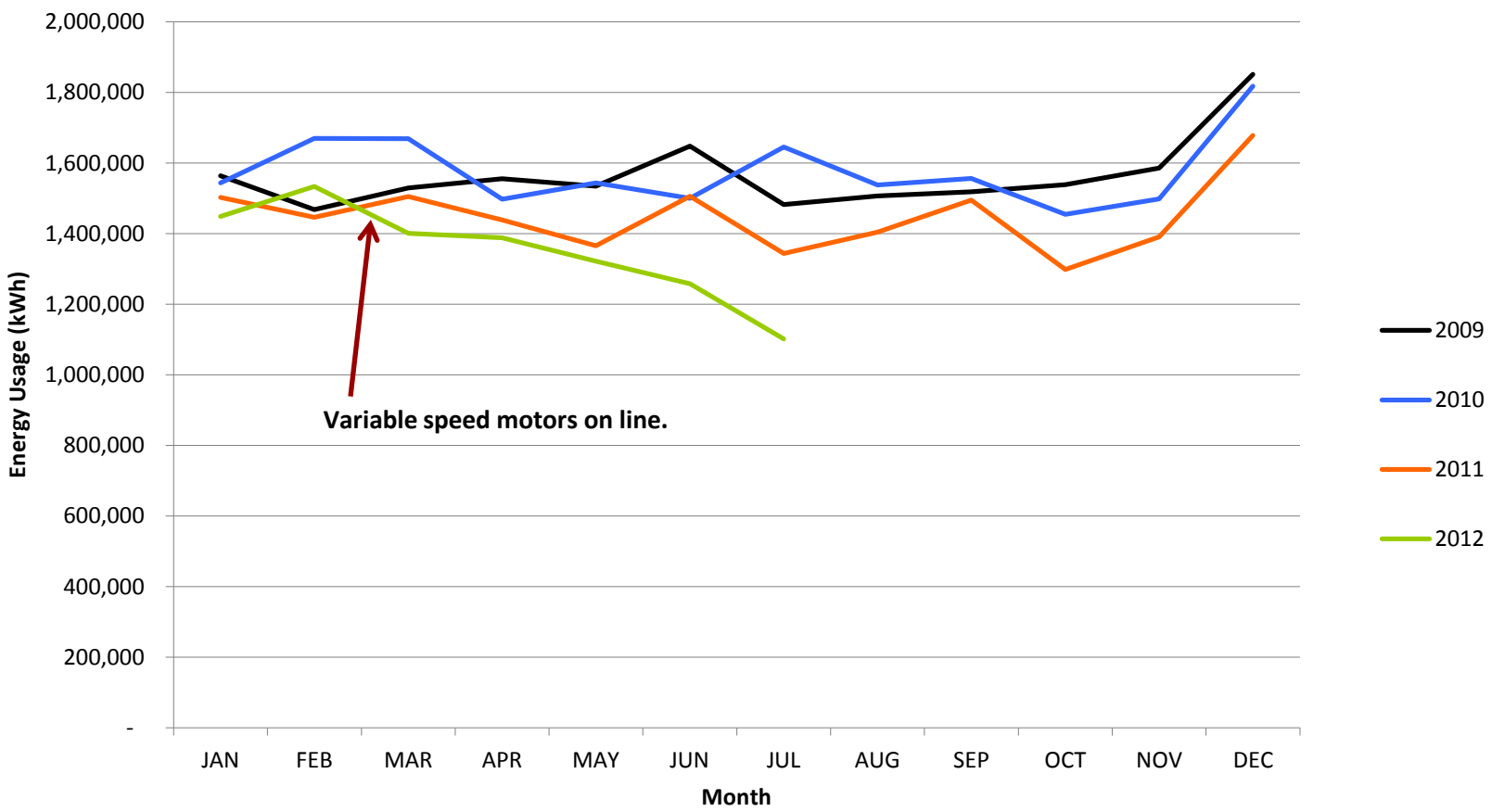
Evaluate Progress

- ✓Review energy use data & activities
- ✓Compare effectiveness to performance goals
- ✓Document “best practices”
- ✓Create new action plans
- ✓Set new performance goals

Implement Action Plan

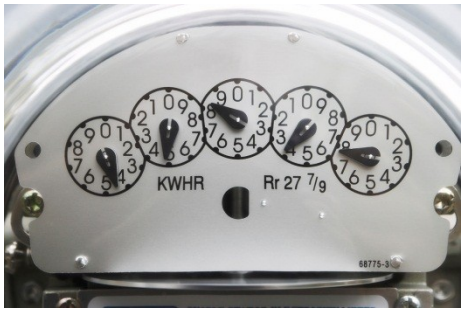
5	Implement Action Plan	Status	Start	Complete
5.1	Create communication plan for employees, customers & stakeholders	GREEN	1-Dec-12	31-Jan-13
5.2	Raise awareness with energy facts & figures (E2 Tips in Internal Communication)	GREEN	1-Dec-12	31-Mar-13
5.3	Build capacity through training & best practices	GREEN	1-Dec-12	15-Apr-13
5.4	Motivate with incentives & recognition	GREEN	1-Dec-12	31-May-13
5.5	Track and Monitor - update, review & identify necessary corrective actions	GREEN	1-Dec-12	15-Jun-13
5.6	Consider Purchasing ENERGY STAR labeled equipment	GREEN	1-Dec-12	30-Jun-08
5.7	Consider Designing new facilities to ENERGY STAR specifications	RED	1-Dec-12	15-Sep-13
5.8	Consider becoming an ENERGY STAR Partner	GREEN	1-Dec-12	15-Jan-13

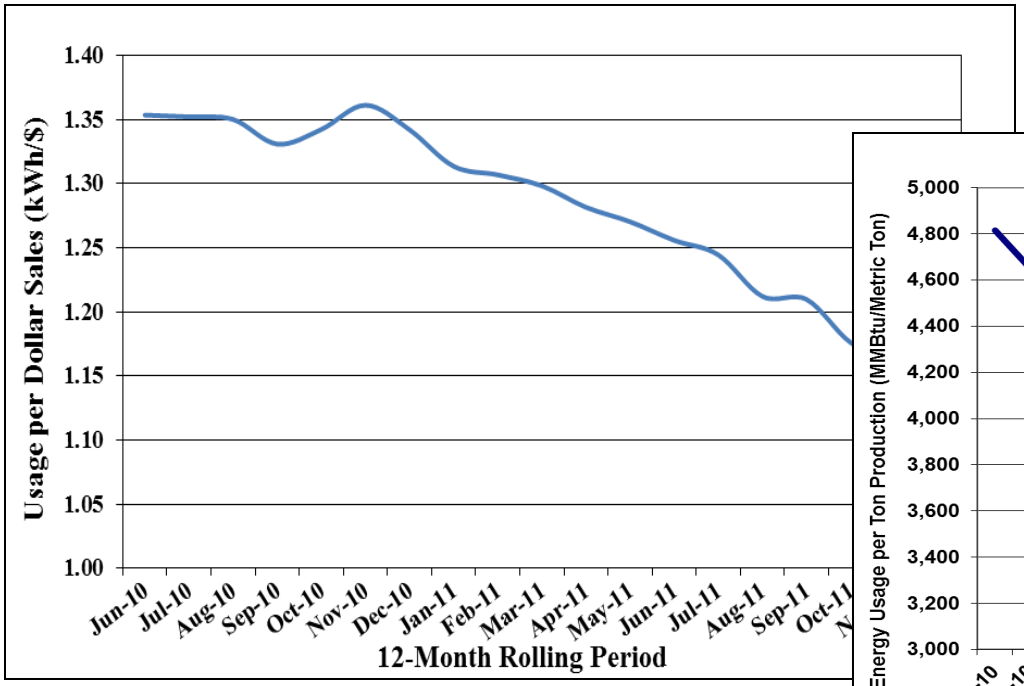
Energy Usage 2009-2012 in kWh per month Normalized for Weather Variance

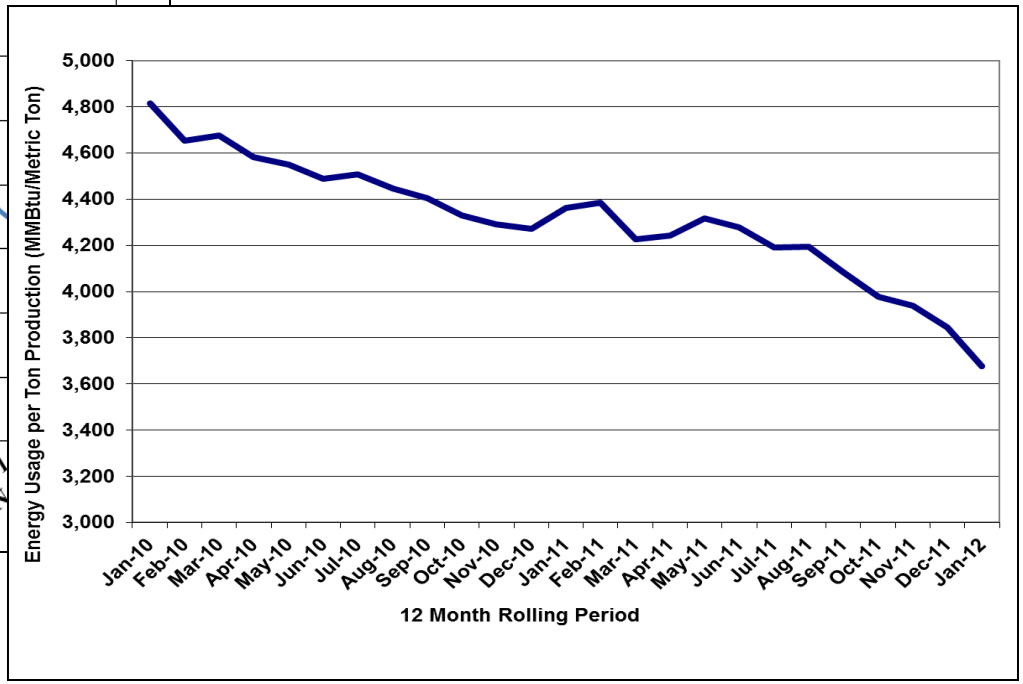


Measure Results

- Energy performance improvement







Declining Energy Intensity!

7-Step Energy Management Process (EMP)

Recognize Achievements

- ✓Facility, team & individuals
- ✓Energy use & cost reductions
- ✓Emission/pollution reductions
- ✓State & National Recognition & Awards Programs

ENERGY STAR PARTNER

Why Recognize Achievements?

- Sustains momentum and support for your energy management program
- Motivates and builds a sense of pride and ownership of the program
- Helps individuals understand how their actions directly affect the organization's goals and objectives

"What gets recognized gets repeated!"

Recognition Program – Implement the 7-Steps

Achievement Level	Necessary Attributes
★	• Sign KY SEN Pledge • Establish Energy Use Baseline
★★	• Institute Energy Management Policy • Establish Cross-Functional Energy Team • Attend Energy Management Training
★★★	• Assess operations for Energy Saving Opportunities • Develop Energy Action Plan (must include 2.5 percent/year minimum goal)
★★★★	• Implement Energy Action Plan • Evaluate Progress of Energy Management Program
★★★★★	• Develop Internal Recognition Program • Mentor KY SEN Participants

KY SEN Recognition Program

- CMWA is 2nd KY SEN Member to achieve Level Five status
- Statewide and local media coverage
- Employee awareness and on-site team recognition

CMWA's Environmental Activities Team received the award at their Paris, Kentucky, facility on June 11, 2012.

KPPC is nationally recognized Center of Excellence @ the University of Louisville

KPPC has received numerous awards for its accomplishments, including:

- 2013 - US EPA ENERGY STAR *Sustained Excellence* Partner of the Year
- 2012, 2011 - US EPA ENERGY STAR Partner of the Year
- 2013, 2012, 2011, 2008 - National Pollution Prevention Roundtable Most Valuable P2 Program
- 2012 - National Pollution Prevention Roundtable MVP2 Award for Multimedia (KPPC's YouTube Channel)
- 2011 - National Pollution Prevention Roundtable MVP2 Award for P2 Champion (Cam Metcalf)
- 2010, 2009, 2005 - National Pollution Prevention (P2) Roundtable Most Valuable P2 Publication
- 2009 - Southern Growth Policy Board's Innovator Award
- 2008 - USDA Bio Energy Awareness Days Grand Challenge Award
- 2007 - US EPA National Water Efficiency Leader Award for NGOs

Continue the 7-Step Process

LOW HANGING FRUIT CAN RE-GROW!

Energy Policy to Promote & Encourage "Higher & Better Fruit Picking"

- Provides foundation for management & success
- Formalizes senior management's support
- Shows organization's commitment to E2 for employees, the community & other stakeholders
- Involves key people in policy development to ensure buy-in
- Tailor policy to the organization's culture
- Communicate policy to management, all employees & the community

Key Guiding Principles

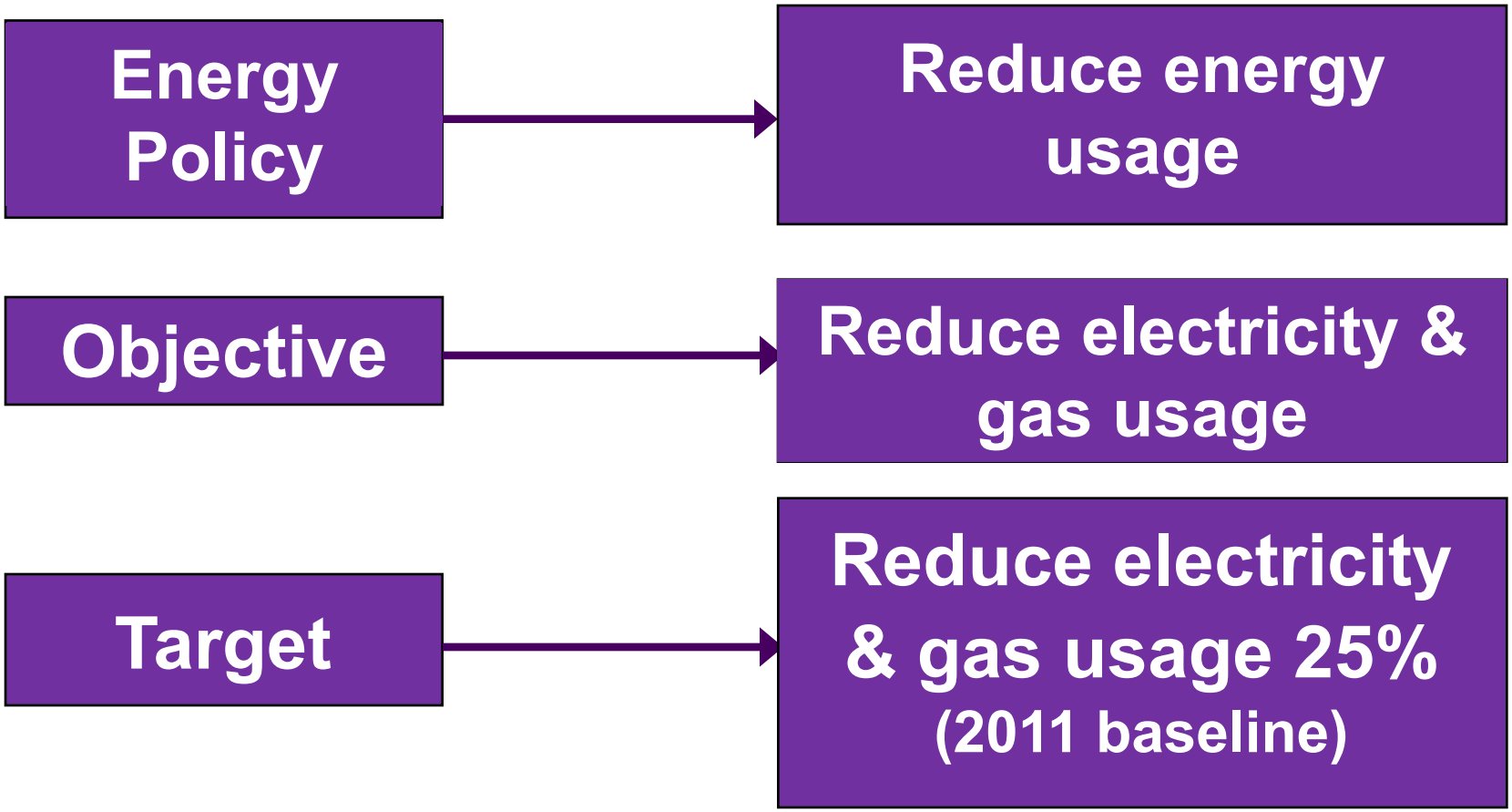
Example: Executing Step 1

7 Step Action Plan			
Step 1			
1 Commitment to Continual Improvement	Energy Team Names	Title	Department
1.1 Appoint Energy Team Lead	John Smith	Plant Manager	Management
1.2 Identify Cross Functional Energy Team	John Smith	Plant Manager	Management
• Plant Manager/Director of Operations	John Smith	Plant Manager	Management
• Controller/Accounting Personnel	Jim Jones	Controller	Accounting Dep
• Engineering Manager			
• Quality Control Manager			
• Quality Assurance Manager			
• EHS Manager	Joe Ford	EHS Manager	Engineering
• Production Maintenance Supervisor			
• Production Supervisor	Ted Brown	Production	Manufacturing
• Hourly personnel			
• Vendor /Supplier(s)			
1.3 Institute E2 & Conservation Policy	Responsibility	Title	Department
1.3.1 Develop the Policy	John Smith	Plant Manager	Management
1.3.2 Communicate Policy Internally	Joe Ford	EHS Manager	Engineering
1.3.3 Communicate Policy Externally	Joe Ford	EHS Manager	Engineering
1.4 Develop a Training Plan for Energy Team	Joe Ford	EHS Manager	Engineering
	Ted Brown	Production	Manufacturing
1.5 Become an EnergyStar Partner	Joe Ford	EHS Manager	Engineering
	Jim Jones	Controller	Accounting Dep

E2 & Conservation Policy Advantages

- Creates a focus on energy usage
- Driver for energy efficiency management
- Provides direction in delivering mission
- Drives targets & objectives
- Supports sustainability
- Changes behavior

Commitment to Continual Improvement
The Policy Drives Objectives & Targets



Environmental performance = measurable results based on the policies, objectives & targets!

Sustainability Training Focus for Energy Team

Training to enable economic growth for organization to succeed in a sustainable business environment

Training to enhance ‘green’ skills & capabilities for workers to address Pollution Prevention (P2), Energy Efficiency (E2) & Sustainability challenges

Creating workers *certified* in a variety of 'green' skills

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Energy Tracking, Baseline & Benchmarking

Richard Meisenhelder

Program Manager- Technical Services

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What to do with your energy data?

Tracking

Baseline

Benchmarking

What is Baseline & Benchmarking?

- Baseline – Initial collection of data which serves as a basis for comparison with subsequently acquired data
- Benchmarking – Measurement and comparison of the facility's own energy use over time or a comparison to similar facilities outside the organization

Getting Started

- Determine a “baseline” of energy usage for all facilities
  - Identify high usage facilities
    - Electricity, natural gas, water
  - Identify energy saving opportunities for these facilities
  - Develop and continue to track energy benchmarks
    - Costs ($/production unit, $/ft^2)
    - Energy (kBtu/ft^2, kBtu/production unit)
    - Demand (kW/month)

Energy Units – Electric Service

kW = unit used to measure electrical demand (power)

- Usually calculated in 15 or 30-minute intervals
- Peak Demand = Greatest value in any 15 or 30-minute interval
  - Ex. 1,000 kWh/0.50 Hr = 2,000 kW Demand

kWh = unit used to measure electrical energy

- 1 kWh = 1,000 Watts of power used for 1 hour
- 1 kWh = 3,412 Btu = 0.003412 MMBtu

Energy Units – Electricity Analogy

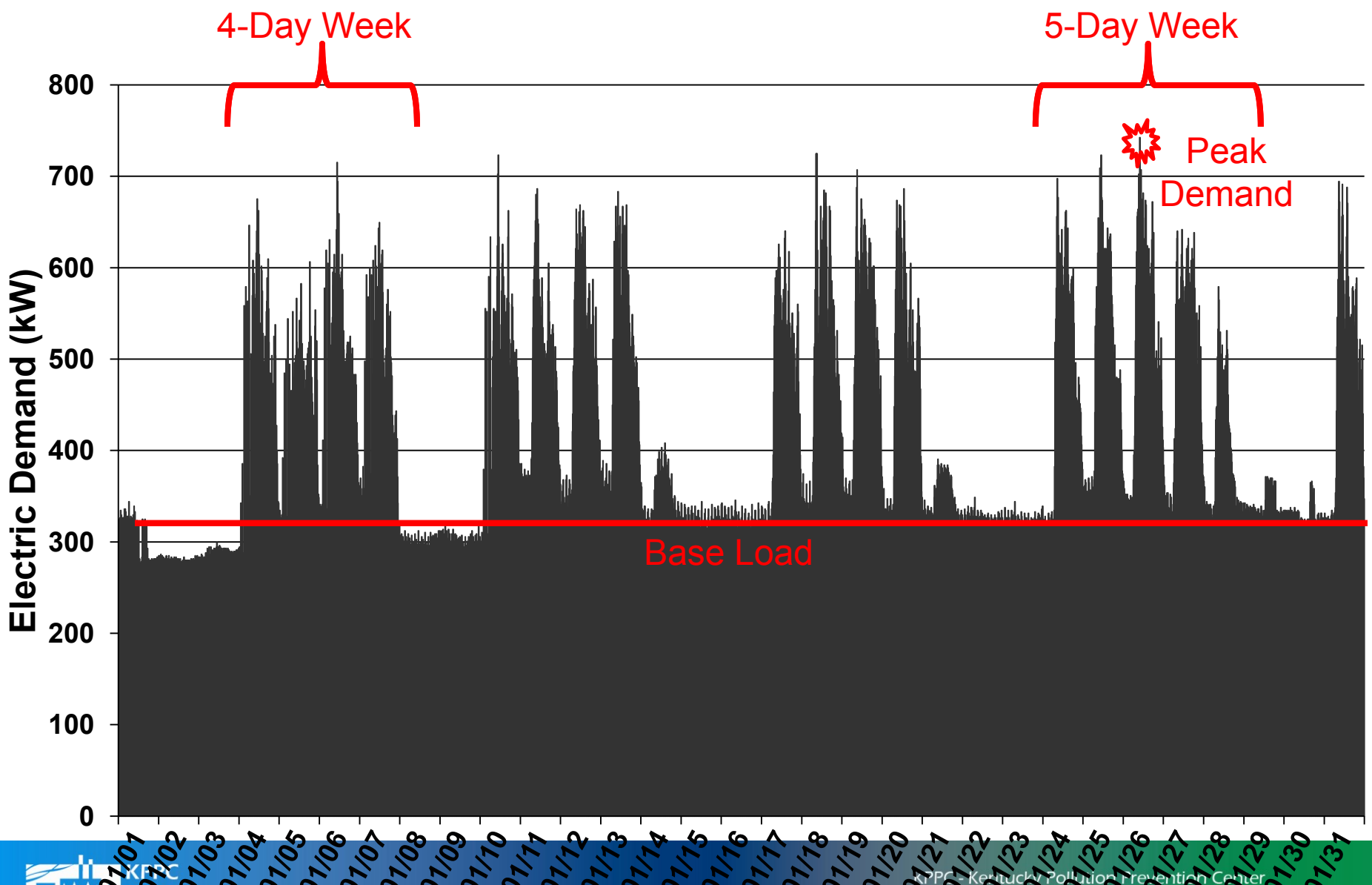
Electrical Charges typically have two metered components:

1. **Demand (Power)**
2. **Consumption (Energy)**

Electric Demand

- Where Usage (kWh) is cost for producing the electricity, Demand is cost for the utility infrastructure to maintain the capacity to meet the service area needs at all times.
  - Demand for large users varies sporadically over days/weeks. Utilities must maintain capacity for those peaks or purchase from other providers.
- Demand is metered on a Peak, 15, or 30 minute interval meter and billed as highest peak energy requirement for month in kW or kVA
  - Demand interval data may be available from utility
  - Aides in identifying load shifting/shedding opportunity

Monthly Demand Interval Data



Natural Gas Utility Service

- NG Charges typically have two metered components:
  - Supply/Purchase Adjustment – The cost to purchase natural gas from wholesalers
  - Distribution/Transportation – The cost to deliver natural gas to the customer
- Miscellaneous fees and taxes

Natural Gas Purchasing

- Energy Units – Natural Gas Service
  - CCF – One hundred cubic feet
  - MCF – One thousand cubic feet
  - MMBtu – Million British thermal units
  - (ROT is 10 ccf per MMBtu)
  - Dth – dekatherm (~10 ccf = 1 dth)
- Purchasing Options
  - Third Party Purchasing
  - Utility Service

Why Track your Energy?

- Identify trends
- Identify irregularities in usage, demand and cost
- Identify errors in utility bills
- Use information to compile energy performance reports

How to Track your Energy

- Collect Data
  - Level of detail (utility bill or sub-metering)
  - All Energy Sources
  - Facility & Operational Data
- Establish Tracking System
  - Scope
  - Maintenance
  - Reporting & Communicating

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Basic Energy Accounting

- Normalizing - process of removing the factors impacting on energy use to fairly compare the energy performance of facilities and operations
- A facility's energy usage/ cost can be normalized using:
  - Building Size (ft^2 of heated/cooled space)
  - Temperature (HDD and CDD)
  - Operation Hours
  - Production Numbers

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Weather Normalization

- Accounting for outdoor temperature variation
- Degree Day – Summation of individual deviations of outdoor temperature from a base indoor temperature
  - A base indoor temperature of 65 F is typically used
  - 1 Heating Degree Day (HDD) = 1 Degree below 65 F for one day
  - 1 Cooling Degree Day (CDD) = 1 Degree above 65 F for one day

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What Tools Can Help me with my Data?

- Spreadsheets
- Energy Star Portfolio Manager / DOE Energy Profiler & Tool Suite
- Utility websites
- Energy Service Provider/Energy Service Company (ESCO)($)
  - Web-based utility tracking & reporting services
  - Real-time energy tracking services

Energy Management Software

How do I choose?

- Items to consider:
  - Accessibility: Internet/Software, User Levels
  - Reporting Abilities: Customizable
  - Data/Bill Verification
  - Size Limitation
  - Sub-Metering
  - Normalizing Capabilities
  - Expense: Setup, Monthly Data Entry Fee, Annual Service Fees

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Assessing Performance and Opportunities – Understanding Utility Bills

Richard Meisenhelder

Program Manager- Technical Services

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Energy Bill Analysis

- Can't manage it if you don't measure it!
- Essential component of any energy management program
  - Continuing account of energy use and cost
  - Keeping up-to-date records of monthly energy consumption and associated costs
  - A separate record will be required for each type of energy used, i.e., gas, electric, oil, etc.
  - A single energy unit should be used to express the heating values of the various fuel sources (MMBtu)

Billing and Rate Structure

- Rate Analysis ("Tabletop" Assessment)
  - Utility companies classify electric and natural gas service according to Rate types
    - Potential Rate Examples: Residential; General Service; Commercial; Industrial
  - Riders modify the structure of a Rate and based upon specific qualifications of the customer
    - Potential Rider Examples: Interruptible; HLF (High Load Factor);TOD (Time-of-Day); Green Energy
  - Tariff Rates & Riders:
    - KY Public Service Commission (http://psc.ky.gov/tariffs/)
    - Utility Website

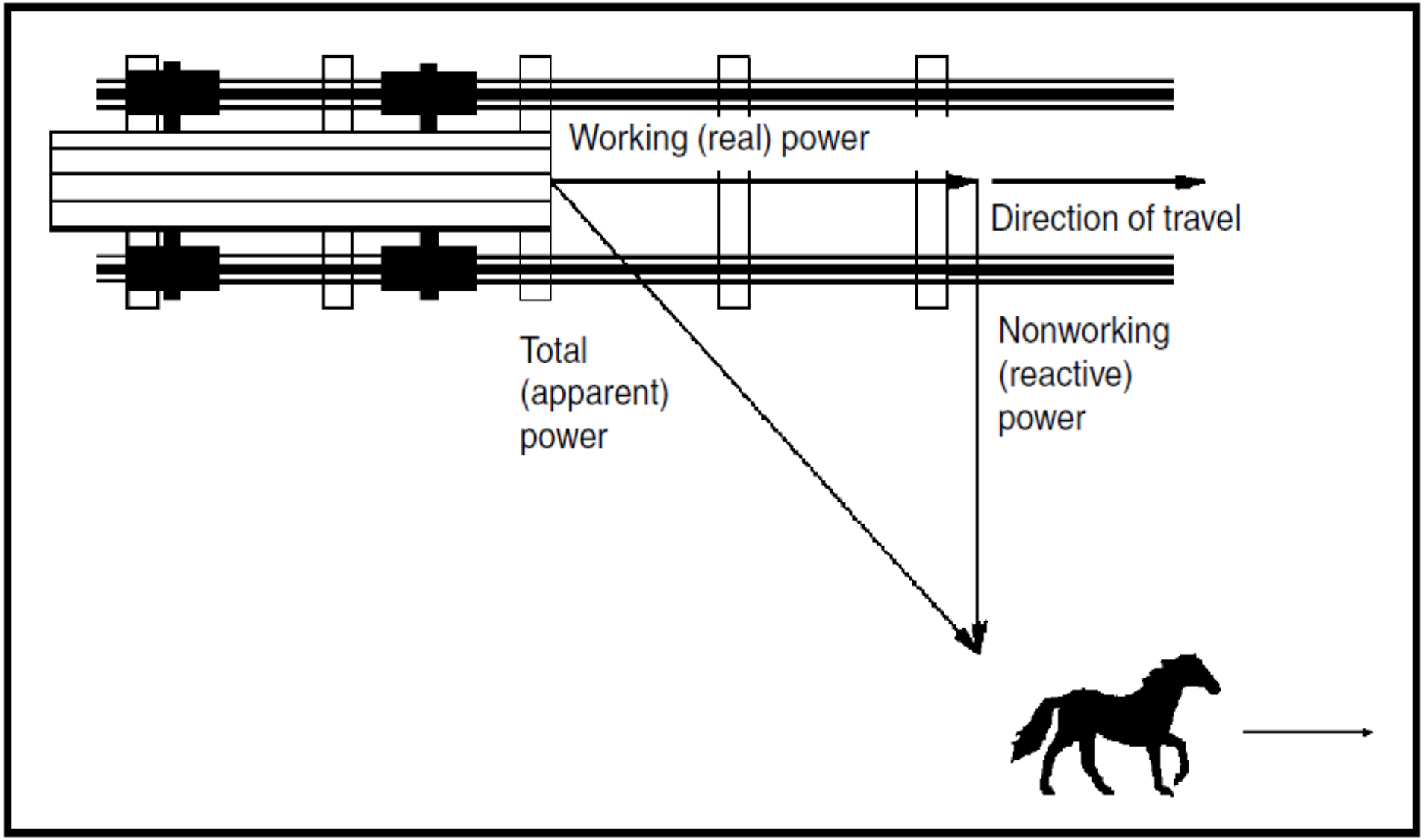
Rate Tariff Analysis

Client Type	Location	Annual Savings ($/Yr)	Percent Savings of Annual Electric Spend (%)
Industrial	Louisville	$26,725	12.8%
Commercial	Lexington	$38,384	34%
Industrial	Elizabethtown	$26,607	7.1%
Industrial	Louisville	$13,691	4.3%
Industrial	Lebanon	$24,000	8.0%
Commercial	Shepherdsville	$16,800	4.1%
TOTAL		**$146,207**	**6.9%**

Power Factor

- Power Factor (PF) is the ratio of Real Power to the Total Apparent Power in an AC circuit
  - It is used as a measure of how efficiently power is being used
- PF is defined as:
  - Real Power divided by Total Apparent Power
  - PF = kW/kVA
- Real Power is that which does work, or runs equipment
- Total Apparent Power is the combination of Real Power and Reactive Power
  - Defined as the product of the total voltage and current in the circuit
  - Reactive Power (kVAr) does not actually do work (creates magnetic fields)
  - Reactive Power is present in any circuit with inductive loads (electric motors, magnetic lamp ballasts, arc welders, etc.)

Power Factor



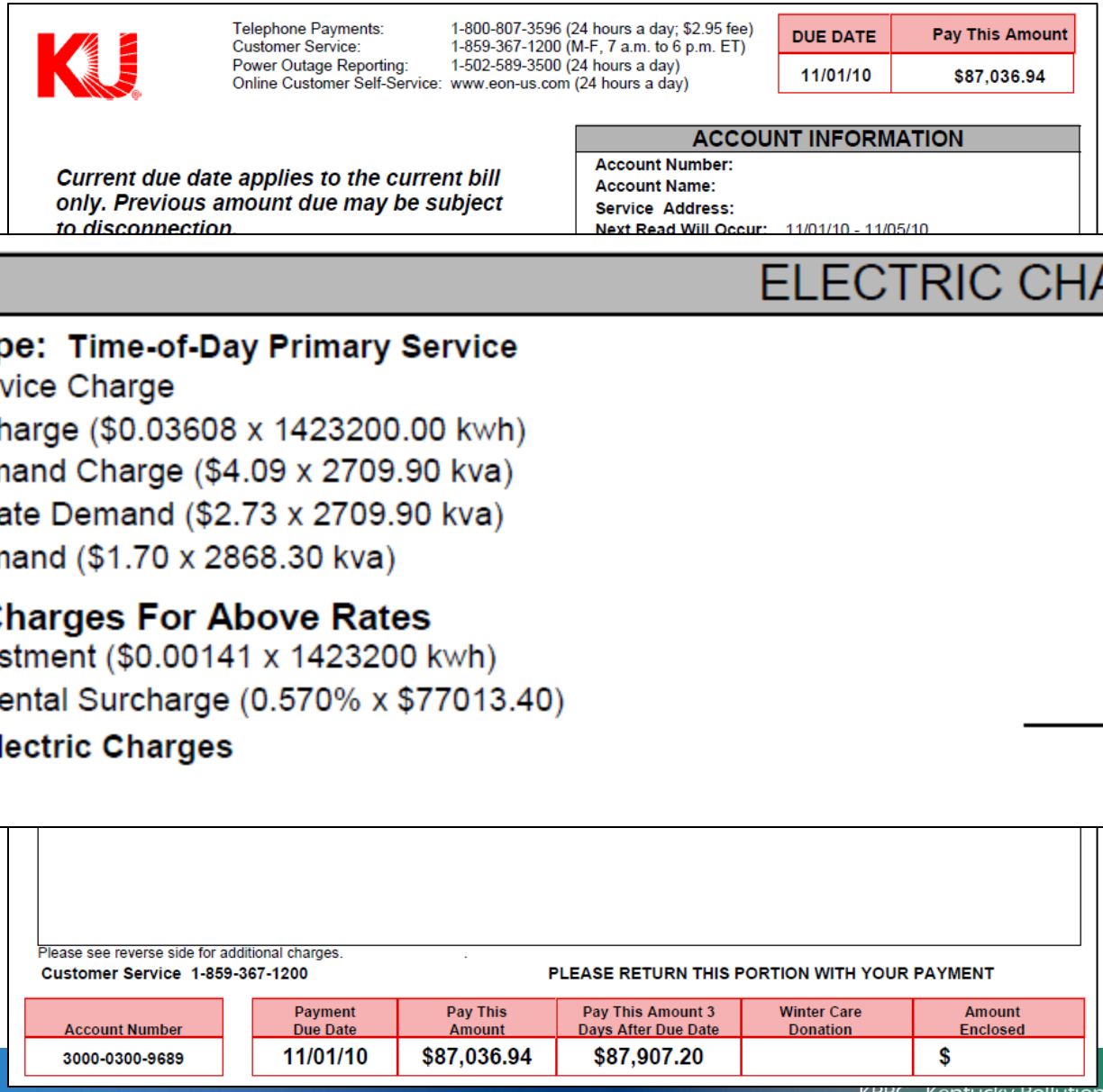
Power Factor

- Low Power Factor
  - Typically caused by using magnetic devices- welding machines, light ballasts, induction motors, electric arc furnaces, transformers…
  - Assessed when below 90% or 95%
- Three Effects of Low Power Factor
  - Robs Distribution System of Capacity
  - Higher Currents = High Voltage Drop & Electrical System Losses
  - Billing Penalty ($)
- Improvements:
  - Capacitors, High-PF Motors and Lighting Ballasts

Other Electric Charges

- Fuel Adjustment Charge – reflects fluctuations in the cost of fuel, or purchased power, used to supply that electricity
- DSM Cost Recovery – reflects costs in establishing and supporting a Demand Side Management Program (Typically Commercial)
- Environmental Surcharge – reflects costs in establishing and maintaining environmental control of emissions from generating electricity

Example Electric Bill



Telephone Payments: 1-800-807-3596 (24 hours a day; $2.95 fee)
Customer Service: 1-859-367-1200 (M-F, 7 a.m. to 6 p.m. ET)
Power Outage Reporting: 1-502-589-3500 (24 hours a day)
Online Customer Self-Service: www.eon-us.com (24 hours a day)

DUE DATE	Pay This Amount
11/01/10	$87,036.94

Current due date applies to the current bill only. Previous amount due may be subject to disconnection

ACCOUNT INFORMATION

Account Number:
Account Name:
Service Address:
Next Read Will Occur: 11/01/10 - 11/05/10

ELECTRIC CHARGES

Rate Type: Time-of-Day Primary Service

Basic Service Charge	300.00
Energy Charge ($0.03608 x 1423200.00 kwh)	51,349.06
Peak Demand Charge ($4.09 x 2709.90 kva)	11,083.49
Intermediate Demand ($2.73 x 2709.90 kva)	7,398.03
Base Demand ($1.70 x 2868.30 kva)	4,876.11

Other Charges For Above Rates

Fuel Adjustment ($0.00141 x 1423200 kwh)	2,006.71
Environmental Surcharge (0.570% x $77013.40)	438.98
Total Electric Charges	**$77,452.38**

Please see reverse side for additional charges.

Customer Service 1-859-367-1200

PLEASE RETURN THIS PORTION WITH YOUR PAYMENT

Account Number	Payment Due Date	Pay This Amount	Pay This Amount 3 Days After Due Date	Winter Care Donation	Amount Enclosed
3000-0300-9689	11/01/10	$87,036.94	$87,907.20		$

Example Natural Gas Bill

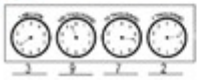
Columbia Gas of Kentuc
A NiSource Comp

How to Contact Us
1-800-432-9345
For DirectLink self-service 24 ho
For billing questions,
call 8 a.m. - 5 p.m., Mon -
For quickest response,
call 11 a.m. - 3 p.m., Tues.
1-800-432-9515
For gas leaks or odor of gas 24 h
Press option 2 after the greeting
711
For hearing-impaired relay
www.columbiagasky.com
For account information, descrip
safety and conservation tips.

Billing Options
E-Bill Go paperless! Sign up
options and view your bill onl
Budget Payment Plan Reduc
higher, unstable natural gas
the cost of winter heating mo
the year. Know how much to
month.

Payment Options
Online Pay free by electroni
site.
ZipCheck Authorize your ban
automatically each month. E
NCO EasyPay Call 1-800-284
Web site to pay by credit/deb
A convenience fee will apply
Authorized Payment Centers
online to find a payment cent
charge a fee for each transa
Mail Return coupon below w
Columbia Gas of Kentucky
P.O. Box 742523
Cincinnati, OH 45274-2523

Gas Meter Informatio
Actual Reading A meter rea
meter. You're required to pro
read the meter at least once
off. Please contact us to mak
access is required.
Estimated Reading During th
read the meter, we accurate
reading based on the history
service address and normal
billing period. We verify the
we read the meter to make s
the energy you've used.
Gas Usage We measure you
equal to 1,000 cubic feet.
How to Read the Meter Whe
between two numbers on a d
the smaller number except when the pointer is
between 9 and 0. Record the reading on the dials
from left to right.
Example:



Detail of Charges for Gas Service

Customer Charge		$25.13
Gas Delivery Charge		$1,233.80
Gas Supply Cost-Volunteer Energy Service		
819.1 Mcf at $6.16600 per Mcf		$5,050.57
Actual Gas Cost Adjustment 819.1 Mcf at -$0.05750 per Mcf	-	$47.10
Research & Development Factor		$11.47
School Tax		$188.27
Accelerated Main Replacement Program Rider		$1.87
Total Charges for Service This Period		**$6,464.01**

You have chosen *Volunteer Energy Services as your supplier in Columbia's CHOICE Program. For questions about your gas supply charges, please contact Volunteer Energy Services at 1-800-977-8374*

Account Number

Statement Date
02/07/2011
378

Service Charges Notes

The Customer Charge *covers a portion of the fixed costs required to ensure that natural gas service is available to your home. This amount is the same with each bill.*

Gas Delivery Charges *are the costs of delivering the gas to retail customers. The charges for these services are regulated and these services must be purchased from the local distribution company.*

Summary

- Understand what rate(s) your facility is on, how each rate works, and how your operations affect your billed energy cost
- Review utility contract(s)
- Discuss rate contract(s) and rate options with your *Utility/Supplier Account Representative(s)*
- Keep future plans in mind when discussing rate and contract options

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Assessing Performance and Opportunities – Energy Management Opportunities

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Assessing Opportunities

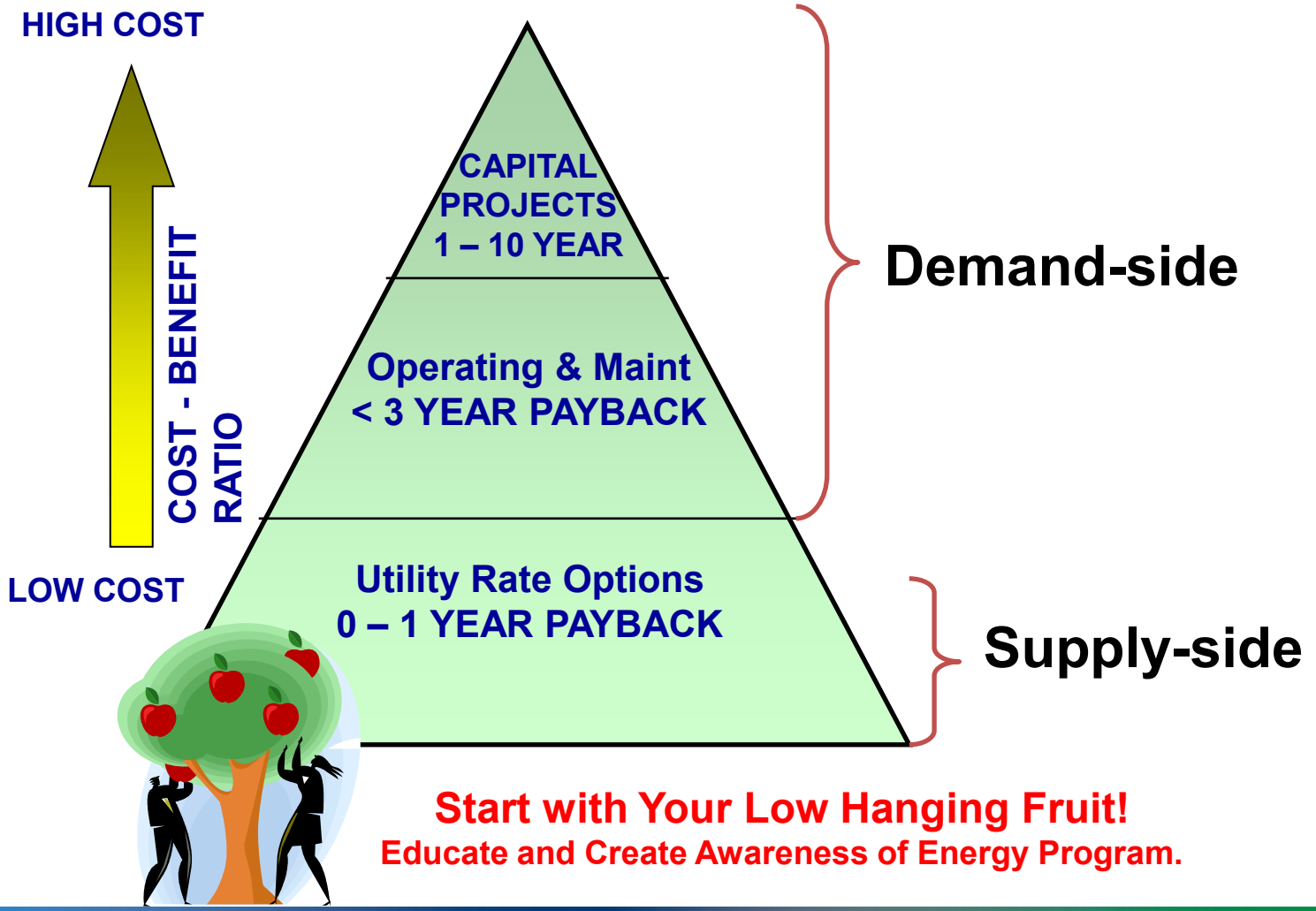
- Types of Opportunities
- Opportunity Hierarchy
- Implement an Energy Management Program
- System Specific Opportunities
  - Lighting
  - Compressed Air
  - HVAC
  - Chillers/Cooling Towers
  - Motors
  - Process Heating
  - Boilers
- Tools of the Assessment

Energy Management Opportunities

- No Cost Examples
  - Switch to a new tariff rate
  - Create an Energy Policy
  - Form an Energy Team
  - Fix compressed air leaks
- Low Cost Examples
  - Install occupancy sensors in conference rooms
  - Install programmable thermostats
  - Annual boiler tune-ups
- Capital Cost Examples
  - Install an economizer on the boiler
  - Upgrade facility lighting
  - Purchase premium efficiency motors

Prioritize Appropriately

Move up the opportunity hierarchy!



Start with Your Low Hanging Fruit!

Educate and Create Awareness of Energy Program.

Implement an Energy Management Program (EMP)

- Institute an energy policy:
  - Commit to environmentally responsible goals
  - State how those goals will be reached
- Form and Empower an Energy Team
  - Designated Energy Manager
  - Production Representative
  - Maintenance Representative
  - Accounting Representative (Payables?)
  - Management Representative

Implement an Energy Management Program (EMP)

Plug Load Management

- Inventory all facility plug loads being left on
- (Computers, personal fans, phone chargers, printers, etc.)
- Educate employees on the importance of turning off equipment
- Purchase Energy Star appliances

Demand Management

- Start-up procedures
- Demand monitoring (real-time or interval data)
- Schedule energy intensive operations on off-peak hours

Implement an Energy Management Program (EMP)

- Plug Load Management
  - PC power settings/security patch management
  - Vending machine power control
  - Standby power
    - Use of power strips
    - Unplug if not using
    - Office equipment
    - ENERGY STAR rated
  - Seasonal shutdown
  - Refrigerators
  - Kitchen equipment
  - Water heaters

Behavior Change

Shutdown program for lighting within Storage Yard, Distribution Center and Shipping/Receiving Canopies

- Energy Savings: 383,074 kWh/Yr
- Project Cost: $0
- Financial Savings: $22,740/
- Payback: Immediate

System Specific EMOs

- Lighting
- Compressed Air
- HVAC
- Chillers/Cooling Towers
- Motors
- Process Heating
- Boilers
- Misc Opportunities

Lighting Opportunities

- T-12s to T-8s
  - About a 20% reduction in power requirements
- Incandescent to CFLs
- Lighting controls
- LED/LEPs where feasible
  - Exit Signs
- Utilize natural daylight
  - Install daylight sensors

Lighting Opportunities

- Replace Metal Halides with Fluorescents
  - High-Bay Fluorescents consume 30%-50% less energy than metal halides
  - Demand reduction
  - Quality of light improves
  - Longer bulb life

Before

After

Lighting Opportunities

- Install Occupancy Sensors
  - Estimated savings in various areas

Type of room	Percentage
Private office	13 to 50%
Open-plan office	20 to 28%
Classroom	40 to 46%
Conference room	22 to 65%
Restroom	30 to 90%
Corridors	30 to 80%
Storage area	45 to 80%

  - Example: Install (9) occupancy sensors in break rooms, conference rooms and restrooms
    - Installed cost: $332
    - Annual Savings: $408
    - Payback: 9.7 Months

Compressed Air Opportunities

- **It's not free!**
- It is a 4th utility
  - Compressed air is expensive and inefficient
  - 7-8HP electricity = 1 HP compressed air
- Compressed air is the only utility that can be 100% controlled.

Compressed Air Opportunities

- Repair leaks
- Reduce system pressure
- Minimize pressure drop
- Utilize heat recovery
- Install more efficient air compressors
- Maintain current compressors
- Ensure adequate storage capacity
- Minimize inappropriate uses

Compressed Air Opportunities

- Fix leaks!
  - One 1/16” leak at 110 PSI costs $483/yr

Operating Pressure (psi)	Leak Orifice Size (inches)	Leak Rate (CFM)	Annual Energy (MMBtu)	Annual Cost Per Leak ($)*
110	1/64”	0.44	1.4	$30
110	1/32”	1.76	5.6	$121
110	1/16”	7.05	22.4	$483
110	1/8”	28.2	89.6	$1,934
110	1/4”	113.0	358.9	$7,749

*Calculated at $0.07/kWh

Compressed Air Opportunities

Fixed 121 compressed air leaks representing 40% of system capacity (1,000 HP)

- Energy Savings: 1,395,794 kWh/Yr
- Project Cost: $0
- Financial Savings: $81,412/Yr
- Payback: Immediate

HVAC Opportunities

- Install Programmable Thermostats
  - Identify good candidate areas
    - Conference rooms
    - Cafeterias
    - Other common areas
  - Check for compatibility with HVAC system
  - Ensure optimal settings, setbacks, and time scheduling
  - Every 1 F adjustment ≈ 1% Savings (for 8 hour period)
    - Significant savings achievable by establishing 10-15 F setback temperatures during unoccupied periods.

HVAC Opportunities

- Install High Volume, Low Speed fans (HVLS)
  - Typical industrial facility will have 20 F temperature differential between ceiling and floor.
  - HVLS fans prevent temperature stratification and reduce heating and cooling loads.
    - Heating bill reductions 20-30%
    - A/C bill reductions range 5%-10%
  - 24ft. Diameter HVLS can move up to 400,000 CFM of air with a 1-2 HP motor
  - Typical paybacks range from 6 months to 2 years

HVAC Opportunities

- Adopt a Preventative Maintenance Plan
  - Filter changing
  - Fan belt replacements
  - Coil cleaning
  - AC condensation drip pans
  - Duct leak prevention

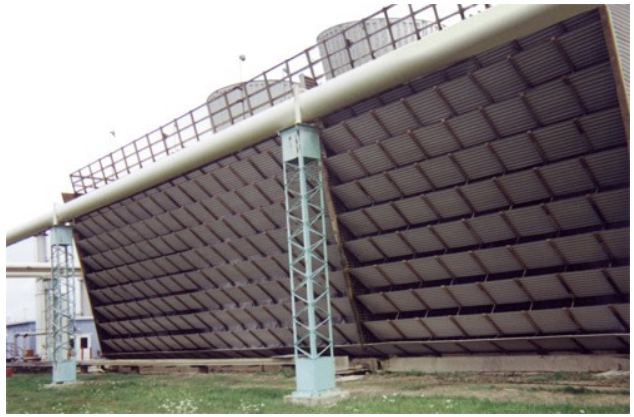
Chillers/Cooling Tower Opportunities

- Raise chilled water temperature
  - For every 1 F increase in water temp, chiller efficiency increases 1-2%.
- Regular chiller maintenance and cleaning
  - For every 0.01 inch of scale deposit on chiller tubes, chiller efficiency drops by 9%.

Motors/VFDs

Installed Variable Frequency Drives (VFDs) on cooling tower pumps (2 x 100HP, 3 x 125HP, & 1 x 200HP)

- Energy Savings: 2,637,085 kWh/Yr
- Project Cost: $214,000
- Financial Savings: $272,000/Yr
- Payback: 0.8 Year (10 Months)



System Specific EMOs

- Electric Motors

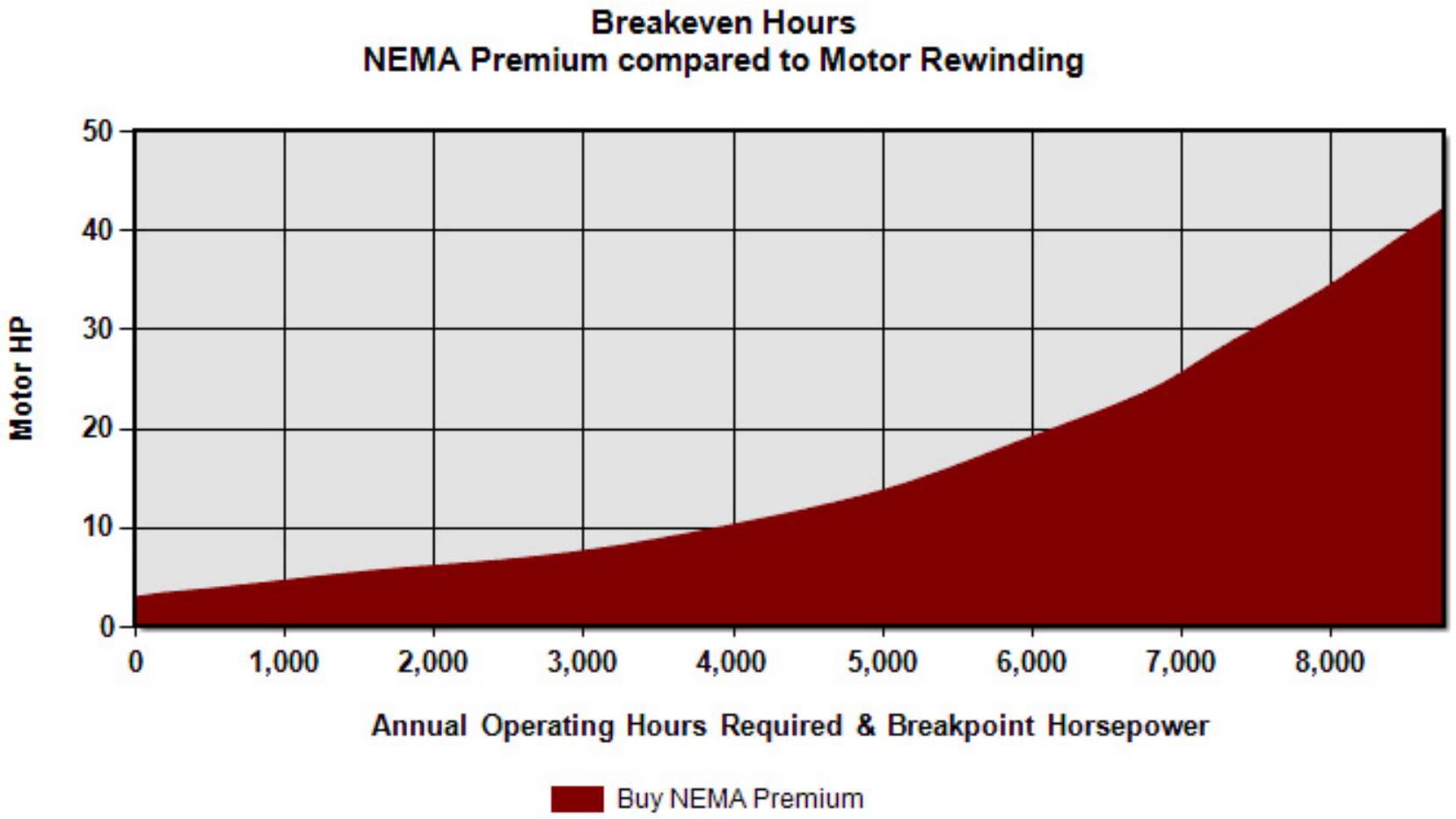
Boilers

- Process Heating
- Misc Opportunities

Motor Opportunities

- Establish a Motor Policy
  - Include rewind vs. new decision guidelines:
    - Electricity cost
    - Annual operating hours
    - Critical motors
  - Establish minimum threshold size before rewind considered
  - Know your rebuild shop's efficiency track record
    - Typically, rebuilt motors lose 1-3% efficiency per rebuild
    - Typical rebuild costs = 60% of new motor cost
  - Review EASA, MotorMaster and other guidelines

Motor Opportunities



Motor Opportunities

- Target large motors with high operating hours
- Consider Variable Frequency Drives (VFDs) and other controls
  - Reducing speed (flow) by 20% can reduce power requirements by approximately 50%
- Look for improperly sized motors
- Turn motors off when not in use
  - 1-minute of running time requires more energy than starting a motor
  - Max No. of starts provided in NEMA 10-2001 MG

Motor Control

Auto shutdown for vertical presses (60 HP to 125 HP) and conveyors on process lines that operate in “idle mode” for 30 minutes

- Energy Savings: 212,877 kWh/Yr
- Project Cost: $0
- Financial Savings: $15,000/Yr
- Payback: Immediate

Boiler System Opportunities - Supply

System Control:

- Optimize boiler loading (i.e. use smaller boiler during low Load conditions)

Combustion:

- Inspect/maintain burners
- Reduce moisture content of fuel
- Minimize air infiltration
- Reduce Excess Air (ensure complete combustion)

Boiler System Opportunities

- For every 10% increase in excess air, boiler efficiency drops approximately 1%.

Excess %		Combustion Efficiency Flue Gas Temperature Minus Combustion Air Temperature, degree F				
Air	Oxygen	200	300	400	500	600
9.5	2.0	85.4	83.1	80.8	78.4	76.0
15.0	3.0	85.2	82.8	80.4	77.9	75.4
28.1	5.0	84.7	82.1	79.5	76.7	74.0
44.9	7.0	84.1	81.2	78.2	75.2	72.1
81.6	10.0	82.8	79.3	75.6	71.9	68.2

Boiler System Opportunities

- Heat Transfer:
  - Annual tune-up/cleaning (1/64” Scale = 1% Efficiency)
  - Evaluate turbulators on firetube boilers
    - Increases flue gas mixing for a balanced gas flow through boiler tubes
    - Improves boiler efficiency
    - Install cost $10-15 per boiler tube
    - Reduce fuel cost by ~4%

Boiler System Opportunities

- Heat Recovery:
  - Exhaust stack:
    - Condensing economizers save 5-6% fuel costs
    - Non-condensing economizers save 2-3% fuel costs
    - Preheat Combustion Air and Inlet Water
  - Blow Down: Optimize & recover heat
  - Condensate: Filter and return condensate to boiler
    - Reduces make up water
    - Pre-heat of boiler feed water to lower fuel costs
    - Lowers chemical treatment costs – condensate is already treated!

Boiler System Opportunities

Demand Side:

- Insulation
- Steam trap maintenance
- Condensate Recovery
- Repair Steam Leaks

Repair Steam Leaks

Operating Pressure (psi)	Leak Orifice Size (inches)	Annual Energy (MMBtu)	Annual Cost Per Leak ($)*
100	1/8”	936	$1,872
100	3/16”	2,082	$4,164
100	1/4”	3,744	$7,488
100	5/16”	5,790	$11,580
100	3/8”	8,286	$16,752
100	7/16”	11,352	$22,704
100	1/2”	14,880	$29,760

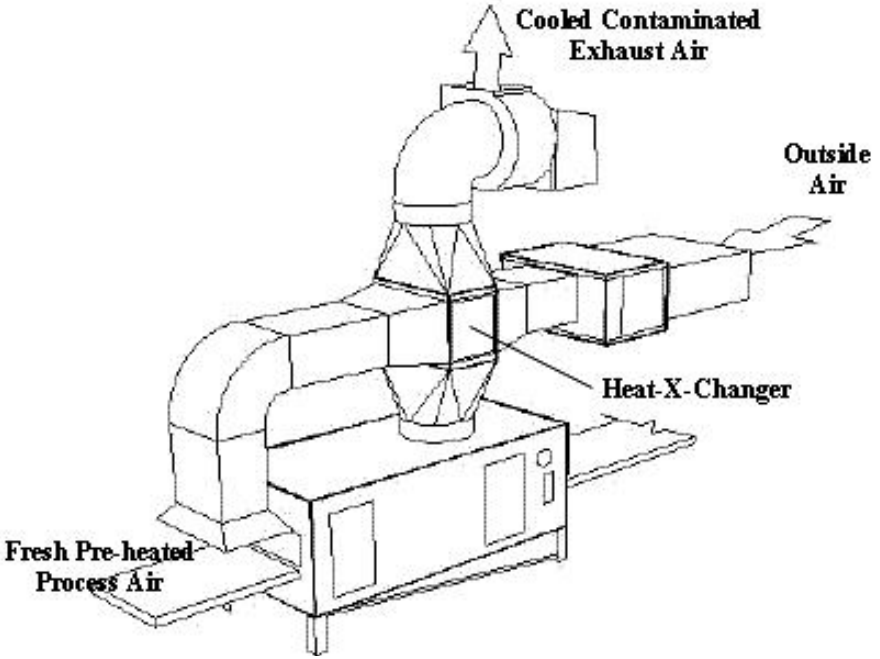
*Calculated at $2.00/MMBtu

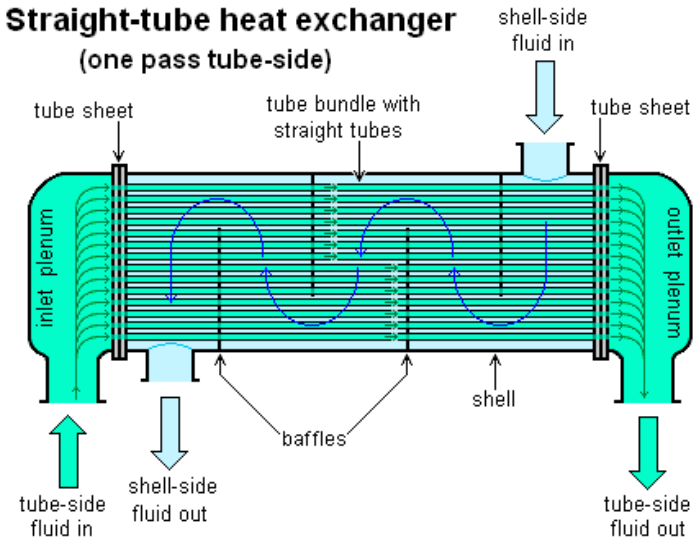
Process Heating Opportunities

- Heat Exchangers
  - Types of Heat Transmission
    - Steam-to-Water
    - Water-to-Water
    - Steam-to-Air
    - Air-to-Water
    - Air-to-Air
  - Typical Efficiencies
    - Air – 75%
    - Water – 80%
    - Steam – 85%

Process Heating Opportunities

- Heat Exchangers
  - Common Types
    - Plate
    - Shell and Tube
    - Heat Pipe





Process Heating/Recovery

Non-condensing economizer on boiler stack exhaust to preheat inlet water. Reduce boiler load from 2 to 1 boiler (500 BoHP)

- Energy Savings: 4,131 MMBtu/Yr
- Project Cost: $29,388
- Financial Savings: $27,853/Yr
- Payback: 1 Year

Process Heating/Recovery

Installed 45 barrel blankets on injection molding machines (50 to 700 Ton)

- Energy Savings: 1,081,268 kWh/Yr
- Project Cost: $76,650
- Financial Savings: $47,949/Yr
- Payback: 1.6 Years

Miscellaneous Opportunities

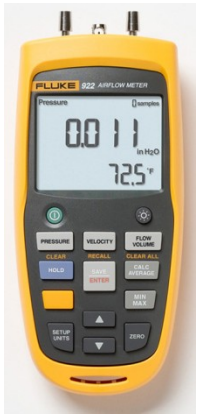
- Power Factor Correction
  - Add capacitor banks
    - Cancels the inductive effects of the load
    - Can be added as a bank of capacitors or to individual pieces of equipment
    - Eliminates costs associated with low power factor
    - Improve power quality in facility
    - Average install cost of $45-50/kVAR installed
  - Can be added to individual pieces of equipment
  - Typical payback in 1-2 years

Miscellaneous Opportunities

- Building Envelope Projects
  - Outside air dampers
  - Cool roofs
  - Solar tube daylighting
  - Window films
  - Insulation repairs/upgrades
  - Air duct sealing/insulation
  - Due to possibly longer payback periods, consider bundling these with other projects

Tools of the Assessment

- Infrared camera
- Airflow meter
- Data loggers
- Temperature probes
- Ultrasonic leak detector
- Multimeter
- Light sensors
- Combustion analyzer



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Corporate Guidelines and Goals

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Typical Corporate Guidelines

Payback Requirements :

- Must payout within a specified number of years. Frequently a 1 to 5 year period

Cost Requirements:

- Must not exceed a specified maximum expenditure

Example - Guidelines on Handout

ABC's Indianapolis Plant

Corporate Guidelines for Energy Cost Savings Projects:

- Payback of 3 years or less
- Capital expenditures not to exceed $100,000 per project
- Total Capital Expenditures not to exceed $300,000
- Savings measured against baseline year

Goal Guidelines

Goals give you something to measure your success

- Make your goals achievable
- Make your goals fit the culture of your company
- Do not set too many goals
- Periodically review and revise goals
- Communicate your goals

Example - Goals on Handout

ABC's Indianapolis Plant

Energy Goals for Upcoming Calendar Year:

- Reduce total energy consumption by 5%
- Reduce average monthly electrical demand by 20%
- Train 80% of employees on proper shut down/start up procedures
- Reduce CPU by 10%
- Reduce GHG emissions by 2%
- Achieve EUI reduction of 4%
- Reduce Energy Use per Unit by 3%

Decide Action Plan:

- What action plans do you need to implement to ensure you meet these goals and follow corporate guidelines?

- These Guidelines and Goals for ABC's Indianapolis Plant are to be used in the following Action Plan Exercise